

REMARKS

No claims are amended, no claims are canceled, and no claims are added; as a result, claims 1-7, 12-77, and 186-189 remain pending in this application.

The Office Action Summary at checkbox 1 states, "Responsive to communication(s) filed on 29 November 2004." (Emphasis in original). Further on page 50 the Office Action states, "Applicant's arguments filed 11/29/04 have been fully considered but they are not persuasive." Applicant respectfully submits that a response to a non-final Office Action in this matter (the non-final Office Action being mailed March 22, 2005) was mailed to the U.S. Patent and Trademark Office on June 22, 2005. A copy of the post card as stamped and returned by the Patent and Trademark Office is included with this response.

Based on the language on pages 50-53 of the pending Office Action, Applicant has proceeded under the assumption that the Office Action Summary and the date on page 50 were inadvertently not updated to reflect Applicant's most recently submitted response. Applicant respectfully requests clarification or correction of these dates in the Office Action Summary and on page 50 of the Office Action. Further, if the Applicant's stated assumption is incorrect, Applicant reserves the right to respond following correction or clarification of these dates.

Applicants maintains all of the arguments submitted in the previous response noted above as having been mailed on June 22, 2005, and therefore includes these arguments below. In addition, Applicants respectfully disagrees with the additional arguments presented in the Office Action on pages 50-53 under the heading "Response to Arguments." Applicant's responses to these additional arguments are included in this response following the restatement of the previously presented arguments.

Supplemental Information Disclosure Statements

Applicant submitted a Supplemental Information Disclosure Statements and 1449 Forms on November 23, 2004 and June 22, 2005. Applicant respectfully requests that initialed copies of the 1449 Forms be returned to Applicant's representatives with the next official communication to indicate that the cited references have been considered by the Examiner.

§103 Rejection of the Claims (as previously submitted)

Claims 1-7, 12-17, 19-21, 23-25, 27-32, 34-36, 38-41, 56-77, and 186-189 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Havemann *et al.* (U.S. 6,358,849) in view of Brown *et al.* (U.S. 6,168,704).

As amended: claim 1 recites, "wherein the selected areas are directly on a top surface of the insulator," claims 4, 12, and 38 recite, "wherein the unused areas are directly on a top surface of the oxide layer," claims 15, 19, 56, and 67 recite, "wherein the selected areas are directly on a top surface of the oxide layer," claim 23 recites, "wherein the selected areas or the unused areas are directly on a top surface of the oxide layer," claims 27 and 34 recite, "wherein the selected areas are directly on a top surface of the polymer layer," claim 30 recites, "wherein the selected areas or the unused areas are directly on a top surface of the polymer layer," and claim 186 recites, "wherein the selected areas are directly on a top surface of the different insulator layer."

The Office Action admits in several places, for example on page 2, that Havemann *et al.* does not disclose removing the barrier layer and the seed layer from selected areas of the insulation. Applicant agrees. Turning now to the secondary reference of Brown *et al.*, at column 6, lines 14-21, states,

The barrier metal and copper seed layers 400A and 400B may be blanket-deposited in the opening 405 and on top of a patterned photomask 407 (shown in phantom in FIG. 4A) that was used to form the opening 405 in the first place. When the patterned photomask is subsequently removed, the portions of the barrier metal and copper seed layers 400A and 400B overlying the patterned photomask 407 are also removed, leaving the barrier metal and copper seed layers 400A and 400B selectively formed only in the opening 405." (emphasis added)

In Brown *et al.*, even after removal of the photomask, the dielectric material 410 is still covered by conductive layer 415, and therefore any areas where the barrier metal layer 400A and the copper seed layer 400B are removed could not be directly on a top surface of the dielectric material 410. Hence, Brown *et al.* fails to teach or suggest the elements of claims 1, 4, 12, 15, 19, 23, 27, 30, 34, 38, 56, 67, and 186 as quoted above.

Thus, neither Havemann *et al.* nor Brown *et al.*, either alone or in combination, teach or suggest each of the elements of claims 1, 4, 12, 15, 19, 23, 27, 30, 34, 38, 56, 67, and 186. Therefore, the Office Action fails to state a *prima facie* case of obviousness with respect to these

claims, and so the Applicant respectfully requests withdrawal of the rejection and reconsideration and allowance of claims 1, 4, 12, 15, 19, 23, 27, 30, 34, 38, 56, 67, and 186.

Claims 2-3, 5-7, 13-14, 16-17, 20-21, 24-25, 28-29, 31-32, 35-36, 39-41, 57-66, 68-77, and 187-189 are dependent on claims 1, 4, 12, 15, 19, 23, 27, 30, 34, 38, 56, 67, and 186 respectively. For reasons analogous to those stated above and elements in the claims, Applicant submits that the Office Action fails to state a *prima facie* case of obviousness with respect to these claims, and therefore respectfully requests withdrawal of the rejections and reconsideration and allowance of claims 2-3, 5-7, 13-14, 16-17, 20-21, 24-25, 28-29, 31-32, 35-36, 39-41, 57-66, 68-77, and 187-189.

Further, the fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990); MPEP § 2143.01. (emphasis added) The Office Action repeatedly, for example on page 5, relies on Brown *et al.* at page 16, lines 42-67 and column 17, lines 1-24 to provide the required suggestion for the desirability to combine Brown *et al.* with Havemann *et al.* The Office Action on page 5 states,

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the barrier layer and the seed layer from selected areas and to deposit the conductor by a selective deposition process only in those areas left after the removal of the barrier layer and the seed layer in the invention of Havemann *et al.* for the disclosed intended purpose of Brown *et al.* of reducing the manufacturing cost, reducing consumption of electroplating solution and CMP consumables, reducing the amount of post-metallization deposition CMP needed and reducing the amount of hazardous effluents as disclosed by Brown *et al.* in col. 16, lines 42-67 and col. 17, lines 1-24. (emphasis added)

As noted in Applicant's previous response (responding to the Office Action mailed July 30, 2004), any saving that might be taught or suggested to by Brown *et al.* (while Applicant does not admit it to be so) relate to the selective deposition of the copper layer, and are not related "to remove the barrier layer and the seed layer form [sic] selected areas" as recited in the Office Action. Further, the cited portion of Brown *et al.* in part states at column 17, lines 17-22 that, "Finally, in any of the above-disclosed embodiments of a method for selectively electrochemically depositing copper according to the present invention, it is not necessary to etch the barrier or seed layers, which can be extremely difficult and time consuming." (emphasis

added) Thus, the statement on page 5 of the Office Action, "to remove the barrier and seed layer form [sic] selected areas and to deposit the conductor . . . " in support of the combination of Havemann *et al.* and Brown *et al.* is directly contradicted by the disclosure in Brown *et al.*

Further, Havemann *et al.* is concerned with CMP processing having manufacturability problems (see column 1, lines 50-51) and at column 3, lines 42-49 states,

(10) Remove the portion of copper and TiN barrier outside of the interconnect trenches by CMP; the CMP also planarizes any bumpiness in the plated copper. Initially use a hard pad to planarize, and then follow with a soft pad. ARC 126 acts as a CMP polish stop; copper polishes faster than the silicon oxynitride. The remaining copper forms interconnects 160; see FIG. 1g.

Thus, Havemann *et al.* removes the copper and TiN outside of the interconnect trenches by CMP as a way of planarizing any bumpiness in the plated copper, and therefore the method of Brown *et al.* of selective deposition of the copper destroys the stated purpose of Havemann *et al.*, that being elimination of manufacturability problems by the use of CMP on copper outside the interconnect trenches. Because the statements in the Office Action in support of the combination of Havemann *et al.* and Brown *et al.* are not supported by the documents themselves, the Office Action fails to state a *prima facie* case of obviousness with respect to claims 1-7, 12-17, 19-21, 23-25, 27-32, 34-36, 38-41, 56-77, and 186-189.

In addition, the Office Action repeatedly, for example on page 7, states or makes statement to the effect that,

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the depth of the trench, thus varying the depth to which the barrier layer is deposited as there is no statement denoting the critically of the depth to which the barrier layer is deposited.

Further the Office Action repeatedly, for example on page 9-10, states or makes statements to the effect that,

Furthermore, it would have been within the scope of one of ordinary skill in the art at the time the invention was made that gold may be used as an alternative to copper or aluminum although copper is preferred over gold, and as Brown *et al.* discloses that the use of gold has been considered in semiconductor interconnections and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments.

Further, on pages 12-13, the Office Action recites,

Furthermore, it would have been within the scope of one of ordinary skill in the art at the time the invention was made that silver may be used as an alternative to copper or aluminum although copper is preferred over silver, and as Brown *et al.* discloses that the use of gold has been considered in semiconductor interconnections and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments.

Applicant disagrees with each of the above or similar statements made throughout the Office Action, and Applicant further submits that these statements are unsupported by the references and therefore are within the personal knowledge of the Examiner. Therefore, Applicant requests that the Examiner provide an affidavit as required by MPEP § 2144.03. If the Examiner can not provide an affidavit, Applicant requests withdrawal of the rejections and reconsideration and allowance of claims whose rejections are based on these statements.

For at least the reasons stated above, Applicant respectfully requests withdrawal of the rejection and reconsideration and allowance of claims 1-7, 12-17, 19-21, 23-25, 27-32, 34-36, 38-41, 56-77, and 186-189.

Claims 42-44 and 50-55 and Claims 18, 22, 26, 33, and 37

Claims 42-44 and 50-55 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Havemann *et al.* in view of Brown *et al.* and Ting *et al.* (U.S. 5,969,422). Further, claims 18, 22, 26, 33, and 37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Havemann *et al.* in view of Brown *et al.* as applied to claims 1-7, 12-17, 19-21, 23-35, 27-32, 34-36, 38-41, 56-77 above, and further in view of Ting *et al.*

As amended, claims 42 and 50 recite, "wherein the selected areas are directly on a top surface of the oxide layer." Claims 43-44 and 51-55 depend from claims 42 and 50 respectively, and therefore include all the elements recited in the claim from which they depend. For reasons analogous to those argued above with regards to claims 1-7, 12-17, 19-21, 23-25, 27-32, 34-36, 38-41, 56-77, and 186-189, neither Havemann *et al.* nor Brown *et al.* teach or suggest these elements of claims 42 and 50 as quoted above. The Office Action does not rely on, and fails to point out in Ting *et al.*, any teaching or suggestion of these elements missing in Havemann *et al.* and Brown *et al.* as recited in claims 42 and 50. Thus, neither Havemann *et al.*, nor Brown *et al.*,

nor Ting *et al.*, either alone or in combination, teach or suggest all of the elements in claims 42-44 and 50-55.

Further, claims 18, 22, 26, 33, and 37 depend from claims 15, 19, 23, 30, and 34 respectively and therefore include all the elements recited in the claim from which they depend. As argued above with regards to claims 15, 19, 23, 30, and 34, neither Havemann *et al.* nor Brown *et al.* teach or suggest all of the elements as recited in claims 15, 19, 23, 30, and 34, and so fail to teach or suggest all of the elements in claims 18, 22, 26, 33, and 37. The Office Action does not rely on, and fails to point out in Ting *et al.*, any teaching or suggestion of these elements missing in Havemann *et al.* and Brown *et al.* as recite in claims 15, 19, 23, 30, and 34. Thus, neither Havemann *et al.*, nor Brown *et al.*, nor Ting *et al.*, either alone or in combination, teach or suggest all of the elements in claims 18, 22, 26, 33, and 37.

In addition, the Office Action does not provide any additional motive for combining Havemann *et al.* with Brown *et al.* with regards to claims 18, 22, 26, 33, 37, 42-44, and 50-55. Thus, for the reasons argued above, the Office Action has failed to state a *prima facie* case of obviousness with respect to claims 18, 22, 26, 33, 37, 42-44, and 50-55 because the Office Action fails to show a suggestion for the desirability to combine the referenced of Havemann *et al.*, Brown *et al.*, and Ting *et al.* that is supported in the prior art.

For at least the reasons stated above, Applicant respectfully requests withdrawal of the rejections and reconsideration and allowance of claims 18, 22, 26 33, 37, 42-44, and 50-55.

Allowable Subject Matter

Applicant acknowledges the allowance of claims 45-49.

Additional arguments newly submitted in this response and responding to the "Response to Arguments" section on pages 50-53 of the Office Action.

On pages 50-51, the Office Action presents exactly the same arguments in response to Applicant's argument that there in no motivation to combine the teachings of Brown et al. and Havemann et al. as was presented in the previous Office Action. The pending Office Action offers no response to the arguments submitted regarding motivation to combine the teaching of Brown et al. and Havemann et al. provided in the response mailed June 22, 2005, and presented

again above. Therefore, Applicant maintains that the statements in the Office Action in support of the combination of Havemann *et al.* and Brown *et al.* are not supported by the documents themselves, and so the Office Action fails to state a *prima facie* case of obviousness with respect to claims 1-7, 12-17, 19-21, 23-25, 27-32, 34-36, 38-41, 56-77, and 186-189.

In addition, because the Office Action fails to provide any additional arguments for forming the proposed combination of Brown *et al.*, Havemann *et al.*, and Ting *et al.*, the Office Action fails to state a *prima facie* case of obviousness with respect to claims 18, 22, 26, 33, 37, 42-44, and 50-55.

On pages 51-52 the Office Action states,

Regarding the applicant's argument that neither Havemann *et al.* nor Brown *et al.* discloses removing the barrier and seed layers *from* selected areas of the insulator and that wherein the selected areas are directly on a top surface of the insulator, oxide, or polymer layer, it is noted that the barrier and seed layers are removed from a top surface of the insulator as shown in Figs. 5F-5H, and as disclosed in col. 8, lines 59-67 where the photomask is removed prior to the deposition of the barrier layer and the seed layer, hence the barrier layer and the seed layers are formed directly on the insulating and selected areas are directly on a top surface of the insulator, and since the method of Brown *et al.* results in removal of the barrier and seed layers from selected areas of the insulator. (Emphasis in original).

Applicant respectfully disagrees. Brown *et al.* at column 8, line 54 through column 9, line 2 recites,

As shown in FIG. 5F, the masking layer 515, along with portions of the barrier metal and copper seed layers 525A and 525B overlying the masking layer 515, may be removed. For example, a masking layer 515 formed of photoresist may be removed by being stripped off in a solvent bath. Alternatively, the masking layer 515 may be removed before the barrier metal and copper seed layers 525A and 525B are formed (for example, by being deposited) to make a conductive path through the barrier metal and copper seed layers 525A and 525B in the opening 520 and through the conductive layer 500. The barrier metal and copper seed layers 525A and 525B shown in FIG. 5D would then be deposited directly on the conductive layer 500, since the masking layer 515 would have been removed before the barrier metal and copper seed layers 525A and 525B were deposited. (Emphasis added).

As underlined above, Brown *et al.* clearly discloses barrier and seed layers shown in Fig. 5F are deposited directly on a conductive layer 500, which separates the dielectric layer 505 from the barrier and seed layer. Brown *et al.* goes on to describe that this particular arrangement is

used to "make a conductive path through the barrier metal and copper seed layers 525A and 525B in the opening 520 and through the conductive layer 500." Thus, Brown et al. clearly fails to disclose for example, "wherein the selected areas are directly on a top surface of the insulator," as recited in claim 1. (Emphasis added). Therefore, Fig. 5 and the disclosure in Brown et al. contradict the arguments presented in Office Action. Applicants maintains that the proposed combination of Brown et al. and Havemann et al., despite the additional arguments presented in the Office Action, fails to teach or suggest the elements of claims 1-7, 12-77, and 186-189. Therefore, the Office Action fails to state a *prima facie* case of obviousness with respect to claims 1-7, 12-77, and 186-189.

The Office Action on page 52 states,

Regarding, applicant's argument that Brown et al. discloses that it is not necessary to remove the barrier material and the seed layer, and that because of this the combination of Havemann et al. and Brown et al. is contradicted, it is noted that the primary purpose of Brown et al. is to selectively deposit copper, and that Brown et al. refers in that complete disclosure of col. 17, lines 6-24 to the embodiments where the barrier material and the seed layer are selectively deposited as well, and when they are selectively deposited, it would only include the opening and any etching would be indeed time-consuming, extremely difficult and rendered unnecessary by the selective deposition. (Emphasis added).

Applicant respectfully disagrees. Brown et al. at column 6, lines 14-22 recites,

The barrier metal and copper seed layers 400A and 400B may be blanket-deposited in the opening 405 and on top of a patterned photomask 407 (shown in phantom in FIG. 4A) that was used to form the opening 405 in the first place. When the patterned photomask is subsequently removed, the portions of the barrier metal and copper seed layers 400A and 400B overlying the patterned photomask 407 are also removed, leaving the barrier metal and copper seed layers 400A and 400B selectively formed only in the opening 405. (Emphasis added).

Thus, Brown et al. does not disclose selectively depositing a barrier material and seed layer as suggested in the Office Action, but instead describes selectively formed barrier metal and copper seed layers by blanket-depositing these layers over a patterned photomask and then subsequently removing these layers. The portion of Brown et al. cited in the Office Action,

specifically column 17, lines 16-24, also discloses selectively forming, and not selectively depositing the barrier and seed layers. Therefore, the saving alluded to in the Office Action would not apply to removal of the barrier and seed layers as suggested in the Office Action in suggesting a motivation to combine the Brown et al. reference with the Havemann et al. reference.

Further, the Office Action on page 52 states,

Regarding applicant's argument about the Examiner's position that Brown et al. discloses that gold, silver and copper are alternatives to aluminum, applicant is directed to Brown et al.'s col. 1, lines 20-45. Furthermore, Ting et al. teaches that gold, silver, and copper among others are well known and interchangeably used in conductor manufacturing as disclosed in col. 4, lines 54-65, although in that instance the materials are suggested for seed layers.

Applicant respectfully disagrees. A careful review of the cited portion of Brown et al. reveals that these metals present various problems (such as corrosion in silver) and constraints (such as cost) when being used in the formation of semiconductor devices, and therefore present various tradeoffs with respect to conductivity, cost, and difficulty in manufacturability. Thus, Brown et al. fails to disclose that these metals are alternatives to one another as suggested in the Office Action. In fact, Brown et al. teaches away from these materials as alternatives to one another in particular applications based on one or more of the characteristics discussed in the cited portion of the specification of Brown et al.

For at least the reasons stated above, Applicant respectfully requests withdrawal of the rejections and reconsideration and allowance all of claims now pending in the application.

Reservation of Rights

Applicant does not admit that references cited under 35 U.S.C. §§ 102(a), 102(e), 103/102(a), or 103/102(e) are prior art, and reserves the right to swear behind them at a later date. Arguments presented to distinguish such references should not be construed as admissions that the references are prior art.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

PAUL A. FARRAR

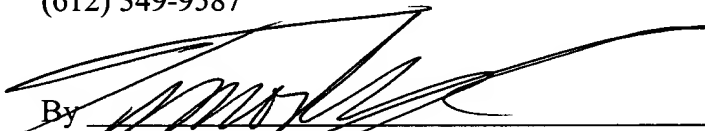
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8 Nov '05

By



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CERTIFICATE UNDER 37 C.F.R. § 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: MS AF, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 8 day of November, 2005.

Name

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